



COMPANY CASE STUDY

Environmentally Smart *and* Economically Smart

“Harvest’s POWER system can increase pizza oven’s energy efficiency and **reduce operating costs** for restaurants. It is exactly the type of **low-carbon solution** that can help our customers make a positive impact on the environment while **keeping affordability in mind**. Enbridge is pleased to be able to support this project through NGIF Industry Grants and its industry partners,”

-Scott Dodd,
Director of
Business
Development,
Enbridge Gas

www.harvestsystems.ca

WHAT WE DO – waste heat from pizza ovens is captured and stored in a fuel-less, **carbon free** water heating system that acts as a drop-in replacement for traditional water heaters, **offsetting utility costs** (electricity or gas) and GHG emissions.

BENEFITS

- A typical Pizza Pizza franchise can save **\$1,500 / year**
- System delivers up to **1,000L / day** of hot water, exceeding peak demand
- **5.6 tCO₂e** is offset each year when displacing gas-fired water heaters

“Pizza Pizza is proud to have played a key role in demonstrating successful proof-of-concept of this **revolutionary technological innovation**... a true win-win for all.”



PAUL GODDARD
CEO of Pizza Pizza

“NGIF Industry Grants supported this project, and I am pleased to see its successful deployment at the Pizza Pizza restaurants. Harvest’s **cleantech solution** is poised to significantly reduce emissions and improve economics through **direct cost savings**,”

said **John Adams**, President and CEO of NGIF Capital Corporation.

“Our Industry Grants program and its focus on de-risking clean technologies through field trials and pilots are part of NGIF’s integrated model of **industry validation**, customer creation, and market commercialization.”



ABOUT HARVEST SYSTEMS

Harvest System’s technology harvests and recycles waste heat in order to reduce operating costs and greenhouse gas emissions in a cost-effective and scalable way. Currently, the company is focused on the \$4.6 billion dollar restaurant industry, where the platform acts as a drop-in replacement for traditional water heaters. Using a novel attachable modular heat reclaimer, waste heat is captured directly from commercial cooking appliances (such as ovens and fryers) and stored in a hot water tank without affecting safety and performance and resulting in an average 2-year payback. The technology was born out of a \$1.7M research collaboration between McMaster University, Pizza Pizza Limited, and Enbridge Gas.

ABOUT PIZZA PIZZA

Pizza Pizza Limited was founded in 1967 in Toronto, Ontario and has grown to become Canada’s leading national Quick Service pizza brand with over 775 restaurants across the country. In 2007, Pizza Pizza acquired the Pizza 73 brand and operates over 100 locations, primarily in Alberta. Pizza Pizza is guided by its vision of “Always the best food, made especially for you,” with a focus on quality ingredients, customer service, continuous innovation, and community involvement.

ABOUT THE PROJECT

The purpose of the project was to demonstrate the ability to meet the hot water demands of Pizza Pizza restaurants, using waste heat recovered from their pizza ovens, and to prove out an attractive return on investment. The project took place at Pizza Pizza’s test facility as well as three pilot locations across Hamilton, Ontario. With funding support from NGIF and its Industry Grants program, Harvest was able to successfully build the first prototypes of the POWER system.

“We certainly benefited from it. We see it as being **environmentally smart and economically smart**. ... To us, what’s beautiful about the solution is that it is energy efficient, and it’s reducing our carbon footprint... . **Sustainability is very important to us** as a company, [to] our brand, our customers, our franchisees. So, you’re covering that and you’re actually **reducing the energy expenditure for a franchisee** so it’s economically more viable for them.”

-Paul Goddard
CEO, Pizza Pizza



THE PROBLEM

Restaurants are energy intense spaces that use a considerable amount of electricity, gas, and water. Cooking is intrinsically inefficient and wastes as much as 90% of the generated heat as exhaust, which is enough to heat 6 homes. This results in CO2 emissions as well as higher utility costs for an industry with slim margins.

THE SOLUTION

The Harvest system improves overall restaurant energy efficiency by repurposing residual heat from commercial cooking appliances (such as ovens and fryers) to a fuel-less, carbon free water heating system that acts as a drop-in replacement for traditional water heaters. The product allows restaurants to improve their operational efficiency and reduce GHG emissions.

THE TECHNOLOGY

The Harvest system is novel in its ability to capture residual heat directly from the appliance’s exhaust flue without affecting the operational performance and safety of the appliance(s) via an attachable modular exhaust heat reclaimer that can scale heat recycling based on the restaurants heating demand. Competing products capture residual heat through ventilation canopy grease filters and capture low-grade heat (30-50°C) along with grease, which reduces utility savings and increases maintenance costs.

By attaching directly to the appliance’s exhaust flue, Harvest’s heat reclaimer captures high grade heat (200-500°C) and stores it at a higher temperature (70-90°C), which improves efficiency and provides high temperature water for use directly into commercial dishwashers. To maintain appliance reliability, the heat reclaimer is also equipped with a novel exhaust control valve to allow precise heat recovery and safe operation of the appliance in the event of a power outage or heat reclaimer system fault.

“Canadians want and need the **affordable, reliable, clean energy service offering** they have come to expect from the natural gas industry. Through investments in technology companies like Harvest, this industry is laying the groundwork to make that service offering even better,”

said **Timothy M. Egan**, President and CEO, Canadian Gas Association and Chair, NGIF Capital Corporation



LOCATION SELECTION

The pilot facilities were selected based on hot water consumption and venting configuration to test the capabilities of the Harvest platform under the appliance venting configurations typically found in commercial restaurants. All locations had electric water heaters.

In addition, it was critical to test the now patented exhaust control valves, which have the ability to bypass the exhaust flow around the heat reclaimer into the downstream venting systems. This was tested both where the appliance had a mechanical and natural ventilation system.

THE SYSTEM

The Harvest system is comprised of a heat reclaimer, exhaust control valves, a thermal storage tank and a hydronic circulatory system. The circulatory system transports the captured exhaust heat from the heat reclaimer to the thermal storage tank. The heat reclaimer continuously recovers exhaust heat until the thermal storage tank reaches a fully charged state, at which point the exhaust control valves vent the excess heat.

Temperature sensors were installed to measure the incoming and outgoing water temperatures on the thermal storage tank. Water flow was also measured using a totalizing flow meter in order to measure real time energy savings.

HOT WATER AVAILABILITY

It was found that the thermal storage tank was fully capable of delivering the required hot water for all restaurant operations using a single pizza oven. The backup electrical heater was utilized 1.3-3.8% of the time over the sample size. Since electrical backup heating will always be available for redundancy, the resiliency of the Harvest platform is unparalleled as compared to traditional hot water tanks since two energy inputs are available.

“As the initial commercial partner of McMaster and Harvest, Pizza Pizza is proud to have played a key role in demonstrating **successful proof-of-concept** of this revolutionary technological innovation, which has the potential to provide ongoing **environmental benefits and economic benefits** for our restaurant operators across the country, a true win-win for all,”

said **Paul Goddard**,
President and CEO,
Pizza Pizza Limited.



ENERGY SAVINGS

Hot water usage was observed to vary between 300-500L per day. Estimated energy savings relied on assumptions of hot water consumption, water inlet/outlet temperatures, and traditional hot water tank efficiency. Actual savings ranged from \$1,052-\$1,209 per year and are projected to be in the range of \$1,226-\$2,593 depending on geographic location.

However, the generated waste heat from all appliances in a single location was 10-20 times greater than the energy required to completely service water heating demands. This means that there is an opportunity to use the significant amount of excess heat for exhaust make-up air and general space heating in the restaurant. This is currently under development and will significantly increase savings.

In addition, full-service restaurants are estimated to use between 2000-3000L of hot water per day, compared to quick-service restaurants at 500L. This increases savings to \$4,904-\$8,964 per year for full-service restaurants.

CONCLUSIONS

Approximately half of the capital cost of the Harvest system is made up of the thermal water tank, which is needed regardless for operations and provides additional resiliency to ensure that a restaurant is never closed due to lack of hot water.

This results in an average payback of 2-3 years over the incremental system cost, which includes installation, for the average Pizza Pizza franchise. As Harvest explores use cases with higher hot water demands and develops additional uses for the waste heat, such as for exhaust make-up air, the payback period will further decline to under one year.

In addition, replacing gas-fired water heaters would result in 5.6 tonnes of CO₂ per restaurant being offset every year, making the Harvest system both “environmentally smart and economically smart”.